

Appl. No. 10/328,745
Amendment dated April 28, 2008
Reply to Office action of January 28, 2008

REMARKS

The above application is hereby amended in response to the Office action dated January 28, 2008.

Information Disclosure Statement

The references cited in the information disclosure statement (IDS) submitted on October 31, 2007 have been carefully reviewed. Pursuant to the Examiner's request, the references which are believed to be of particular significance are identified on the Identification of References Believed to Be of Particular Significance submitted herewith.

Rule 1.131 Declaration of Prior Invention

The invention of the present application predates the effective date (April 7, 2003) of Zimmerman U.S. 7,027,918. The inventors' declarations under Rule 1.131 are submitted herewith. Applicants respectfully request that the rejections based on this reference be withdrawn.

Claims Rejections

Section 112

The present amendments to independent claims 38 and 47 overcome the Section 112 rejections. For example, the "position solution processor" has been replaced with means for computing a GNSS-defined position solution in both claims. Disclosed examples of such position-computing means include the master receiver, the slave receiver and/or a separate computer. [0022]

The "redundant array" language has been deleted and the GNSS receivers are identified as a master receiver (12) and a slave receiver (14), consistent with the drawings and the specification. The subject matter of the remaining claims has been clarified as a system for determining the position of a *single point* on the structure, as

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opposed to the structure itself. For example, a "monitoring point" at a selected slave antenna 18, e.g., located on a dam face (Fig. 2) is disclosed at [0044]. The barge embodiment shown in Fig. 3 computes "a solution of a single point on a rigid body." [0056] Still further, the "known relative" language in reference to the orientation of the structure has been deleted.

As noted by the examiner, the previous claims attempted to combine the embodiment shown in Fig. 1 with the embodiment shown in Fig. 3 and described at [0050]. As amended hereby, independent claim 38 is directed to the embodiment shown in Fig. 3 and independent claim 47 is directed to the embodiment shown in Figs. 1 and 2.

Prior Art

Independent Claim 38 Distinguished

Claim 38, as amended, calls for master and slave receivers and an orientation device providing inputs to means for computing a GNSS-defined single point position solution. The computing means uses input from the orientation device to compute a non-relative point position solution where incomplete GNSS positioning information is available from the receivers due to the structure at least partially blocking at least one of the antennas.

As noted by the examiner, Van Dusseldorp (5,943,008) and Chang et al. (5,777,578) show multiple antennas for determining attitude or orientation of a structure or vehicle on which they are mounted, i.e. a "GPS compass." However, they teach away from the claimed invention including an orientation device providing an additional input to the position-computing means, with the master and slave receivers providing only incomplete positioning information due to the structure partially blocking at least one of the antennas. For example, the use of GNSS-positioning for determining vehicle attitude based on known relative antenna positions would not be effective when the antennas were partially blocked. Thus, these references are clearly distinguishable.

Rorabaugh (6,922,635) was cited in a previous Office action for partially blocked mobile units 101A and 101B (Fig. 4), with compensation being provided in a

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wirelessly networked group of GPS mobile units. Each mobile unit receives partial satellite positioning information. However, the GPS mobile units are independently mobile and therefore do not form fixed relations to each other on a structure. The system depends on the wireless networking to determine positions and ranges of the mobile units. Amended claim 38, on the other hand, is distinguishable because the master and slave antennas are located in fixed relation on the same structure. Moreover, Rorabaugh does not disclose an orientation device for providing an additional input to the position-computing means. Still further, Rorabaugh lacks the common clock or synchronized clocks for the master and slave receivers, which cooperate with the GNSS receivers and the orientation device providing inputs for the position solution computing means to provide non-relative single point position solutions in conditions where the antennas are blocked and the receivers receive incomplete positioning information. The mobile nature and the widespread dispersal of the mobile units in the Rorabaugh system would effectively preclude common or synchronized clocks in the claim 38 context of master and slave antennas and receivers mounted in fixed relation on a structure. Rorabaugh thus teaches away from the invention as presently claimed.

Tang et al. (5,933,110) disclose a GPS-only system for determining the attitude of a vessel, such as a ship (Fig. 1). However, there is no disclosure of an orientation device (other than the GPS system itself) providing the necessary input for a non-relative position determination where the structure (e.g., a ship) partially blocks the antennas.

Toda et al. (6,611,228) and Fukuda et al. (2002/002 9110) also show multiple antennas for determining heading (i.e. attitude) on a ship (Fig. 8 A), but neither discloses antenna blockage by the ship's structure or a separate orientation device providing the necessary inputs for non-relative position determination in the combination of amended claim 38.

Wilson (6,292,132) shows multiple antennas connected to a common clock, but likewise lacks a separate orientation device and position computation where the GPS antennas are partially blocked, using the output from the orientation device as an input to the computing means.

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Independent Claim 47 Distinguished

Claim 47, as amended, also calls for master and slave antennas/receivers, with the structure at least partially blocking at least one of the antennas. Multiple slave antennas are provided with switches and the system includes means for switching among the slave antennas.

Geier (5,202,829) was cited in a previous office action for a vessel trailing tailbuoys, which include GPS receivers and communicate positioning information with a shipboard system. However, claim 47 calls for the master and slave antennas being mounted in fixed relation on the structure, with the structure partially blocking at least one of the antennas. Geier, on the other hand, does not disclose any such GPS signal blockage. In fact, it teaches away from the claimed invention by utilizing the GPS positioning of the tailbuoys for seismic exploration, as opposed to locating a non-relative single point on the structure.

Welles, II et al. (5,864,315) was cited for a temperature sensor in a GPS system in conjunction with dependent claim 44, but otherwise does not disclose the invention of amended claims 38 and 47.

Conclusion

As pointed out by the Examiner, GNSS attitude determination using multiple antennas in fixed relation is known, as is clock-sharing among multiple receivers. *Relative* locations of points on a structure could be determined with such prior art systems from the fixed-relation and orientation information. However, non-GNSS orientation of a structure providing a signal for use in unison with GNSS master and slave antennas and receivers is not shown or suggested in the context of GNSS signals being partially blocked by the structure itself and a single, *non--relative*, GNSS-defined point location being determined. Important advantages are achieved and applications enabled by the features and functions of the present invention as defined by the amended claims 38 and 47. Such applications include fixed and slow-moving structures, such as vessels and dams, which previously presented point-locating problems arising from antennas being blocked by the structure itself.

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None of the prior art references of record, taken singly or in combinations, teach, disclose or make obvious the combination as presently claimed with the elements and features noted above.

The Commissioner is authorized to charge any excess fees, or credit any overpayments to Deposit Account No. 50-3424. The examiner is invited to contact the undersigned by telephone if prosecution of this application can be expedited thereby.

I hereby certify that this paper is being filed by facsimile transmission (571-273-8300) with the U.S. Patent and Trademark Office.

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Respectfully Submitted,

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